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MARK RESOURCES INC MARINA DEL REY CA  
RANGE GATE RESPONSE FOR INTERIM SYSTEM. (U)  
DEC 77 R L MITCHELL  
MRI-149-4

F/G 17/9

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RFSS

RANGE GATE RESPONSE FOR INTERIM SYSTEM

TECH NOTE 105-031 ✓

28 DEC 77

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# RANGE GATE RESPONSE FOR INTERIM SYSTEM

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28 December 1977

## Summary

It has often been assumed that the range gate response in the receiver is triangular for the interim system being simulated on the RFSS. In this memo we compute a more realistic response that is based on the finite IF bandwidth of 20 MHz. We also provide a listing of a subroutine that can be used in the extended target simulation program to compute the range gate response.

## Results

The interim system is based on a short pulse of 125 nsec in length. If the spectrum is not bandlimited, its voltage will be

$$X(f) = \frac{\sin \pi f T}{\pi f T}$$

where  $T = 125$  nsec. The first zero will occur at  $f_0 = 8$  MHz. We will assume that the spectrum is bandlimited, where the shape of the bandpass filter (voltage) is given by

$$\begin{aligned} H(f) &= 1, & |f| &\leq 1/T \\ &= \cos[\pi(fT-1)], & 1/T < |f| \leq 1.5/T \\ &= 0, & 1.5/T < |f| \end{aligned}$$

Note that the half-power width of this filter is  $B = 2.5/T$ , which is 20 MHz for the interim system parameters. The transmitted signal spectrum (voltage) is thus given by

$$Y(f) = X(f)H(f)$$

which is plotted in Figure 1.

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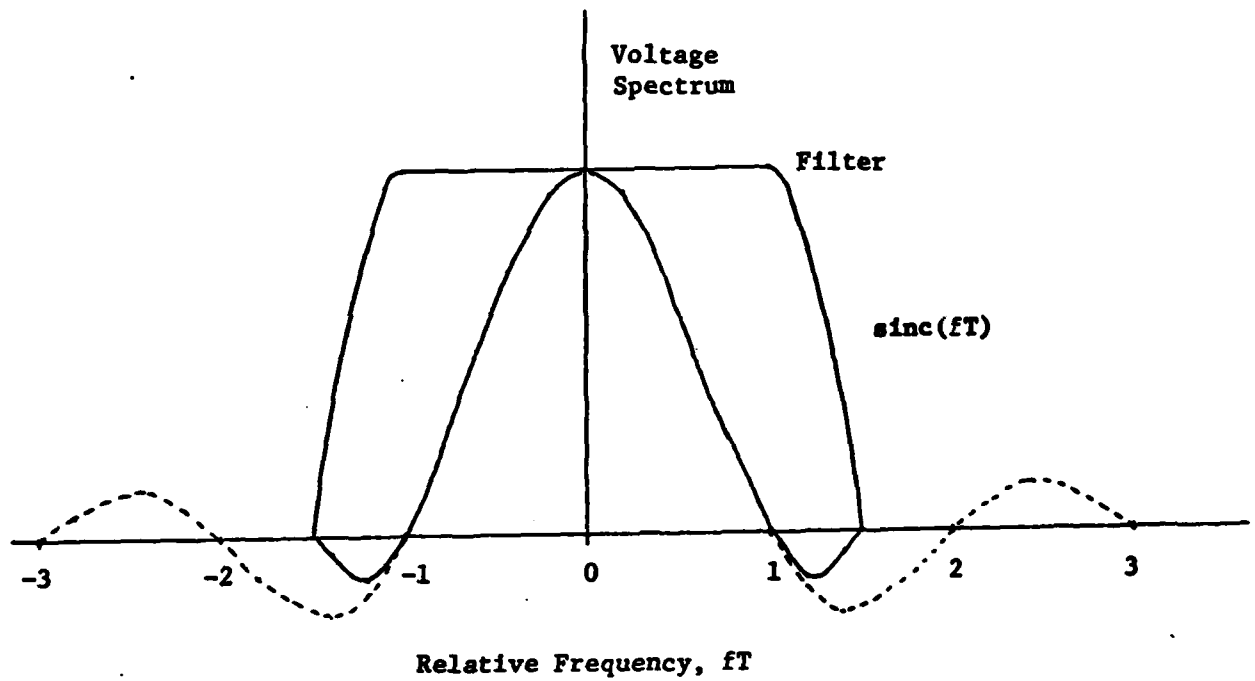


Figure 1. Signal Spectrum.

We will assume that the receiver is matched to the transmitted pulse,  $y(t)$ , which is the Fourier transform of  $Y(f)$ . The receiver is the auto-correlation function of  $y(t)$ , where its spectrum is given by

$$Z(f) = |Y(f)|^2$$

Thus the receiver response  $\chi(\tau)$  is the Fourier transform of  $Z(f)$ . In Figure 2 we show the response for the interim system parameters. Samples of  $\chi(\tau)$  at intervals of  $0.1/T$  are shown below.

$\tau/T$	$z(\tau)$
0	1.00000
0.1	.98104
0.2	.92193
0.3	.81903
0.4	.67431
0.5	.50112
0.6	.32385
0.7	.17071
0.8	.06308
0.9	.00731
1.0	-.00651
1.1	.00182
1.2	.01262
1.3	.01458
1.4	.00713
1.5	-.00313
1.6	-.00898
1.7	-.00762

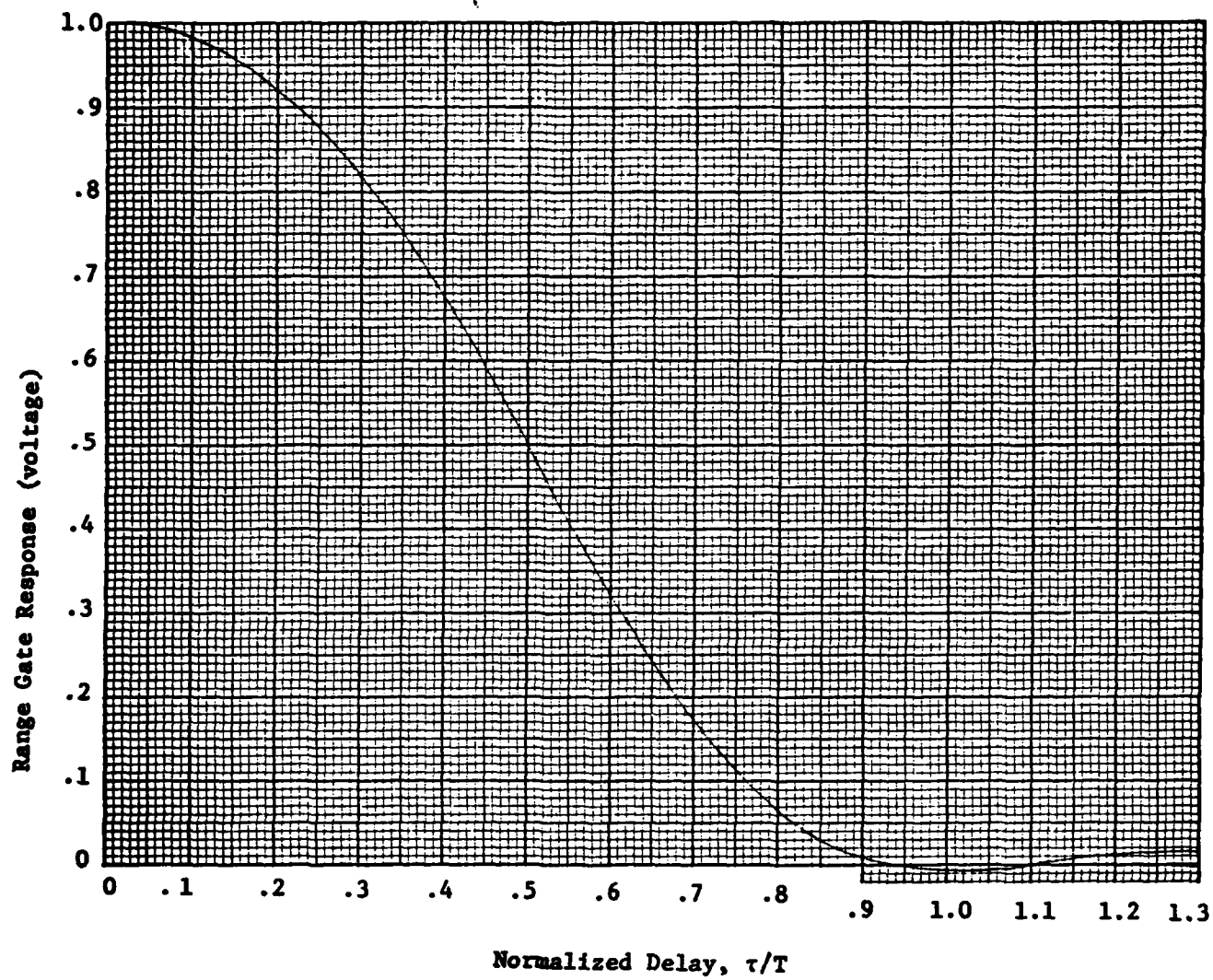


Figure 2. Range Gate Response.

Computer Subroutine

## FUNCTION CHI(P)

C  
 C RANGE GATE RESPONSE. THE ARGUMENT P IS THE RANGE MISMATCH NORMALIZED  
 C TO THE RECEIVER GATE SPACING. INTERPOLATION IS USED ON THE SAMPLES  
 C STORED IN THE A-ARRAY, WHERE THE SPACING IS 0.1 UNIT.  
 C  
 C THE RESIDUAL ERROR IN THE INTERPOLATION IS LESS THAN .0003  
 C  
 C P MUST BE LESS THAN 1.5 IN MAGNITUDE.  
 C  
 C THE SAMPLES ARE OF THE RESPONSE DERIVED IN MRI REPORT 149-4.  
 C

DIMENSION A(18)

DATA A/1.00000, .98104, .92193, .81903, .67431, .50112, .32385,

1 .17071, .06308, .00731, -.00651, .00182, .01262, .01458,

2 .00713, -.00313, -.00898, -.00762 /

H=10.\*ABS(P)

IF(H.GT.15.) STOP 55

I=H

H=H-I

IP1=I+1

IP2=I+2

IP3=I+3

IF(I.LE.0) I=2

CHI=-.166667\*H\*(H-1.)\*(H-2.)\*A(I)+.5\*(H\*\*2-1.)\*(H-2.)\*A(IP1)

1 -.5\*H\*(H+1.)\*(H-2.)\*A(IP2)+.166667\*H\*(H\*\*2-1.)\*A(IP3)

RETURN

END